

Quarkonia Topical Group (QTG) - plans and needs

Friday April 22, 2016

Marzia Rosati & Tony Frawley

Quarkonia Topical Group (QTG) first meeting

Present at the meeting on April 19:

Marzia Rosati

Tony Frawley

Jamie Nagle

Takao Sakaguchi

Gabor David

Rosi Reed

Jin Huang

Mike McCumber

Murad Sarsor

Sasha Lebedev

Discussion at the QTG meeting

We had a long discussion about how to approach the charge from the ALD. We concluded that we were severely handicapped by not having a clear idea of what is included for tracking in the existing cost estimates. We were uncertain if the existing scope contained any money for tracking.

We agreed to ping Gunther and Dave about a collaboration wide discussion of possible de-scoping options that was informed by a clear understanding of what is in the existing scope.

Jamie urged us to be open to looking at options that do not produce good performance for a standalone tracker, but might be acceptable after EMCal matching

- Reduce the number of outer tracker layers
- Consider performance with outer tracker only
- Consider whether we could live with a smaller radius

Discussion at the QTG meeting (cont.)

Mike McCumber discussed the readiness of the TPC simulation: Presently it uses perfect pixels and does not include momentum smearing from space charge effects, or event pileup in the TPC. The simulation uses a cylinder cell, gas voxel approach.

- Need to add momentum smearing code to simulate effects of space charge
- Need to add event pileup

We had discussed this also in the tracking meeting last week. It is a very high priority.

Discussion at the QTG meeting (cont.)

We agreed that using matching to the EMCal as a means of eliminating fake tracks needed to be implemented

- This lessens the demands on the tracking for the Upsilon measurement

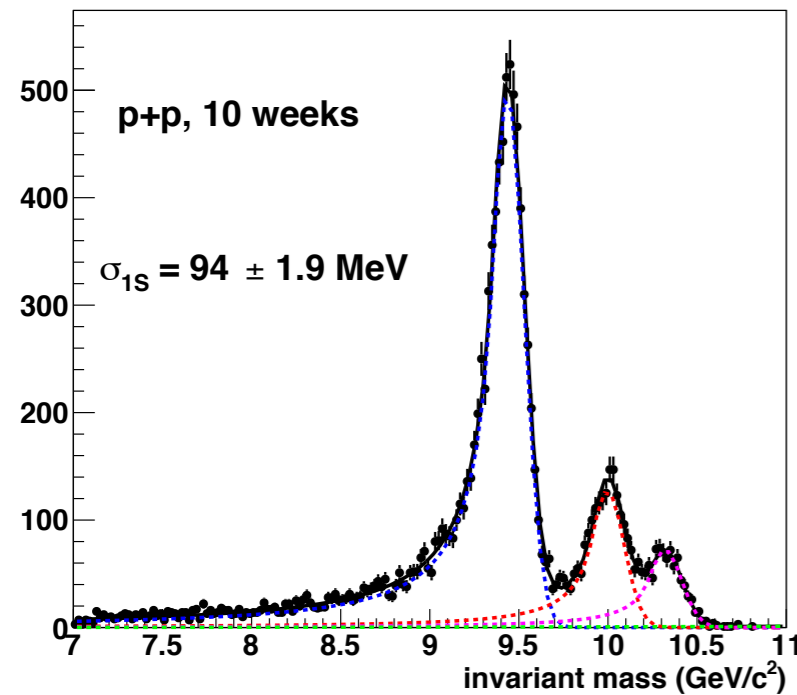
It needs a fast simulation for the calorimeter matching

The Colorado group has been working on matching tracks to calorimeter clusters, and reporting at the simulations meeting

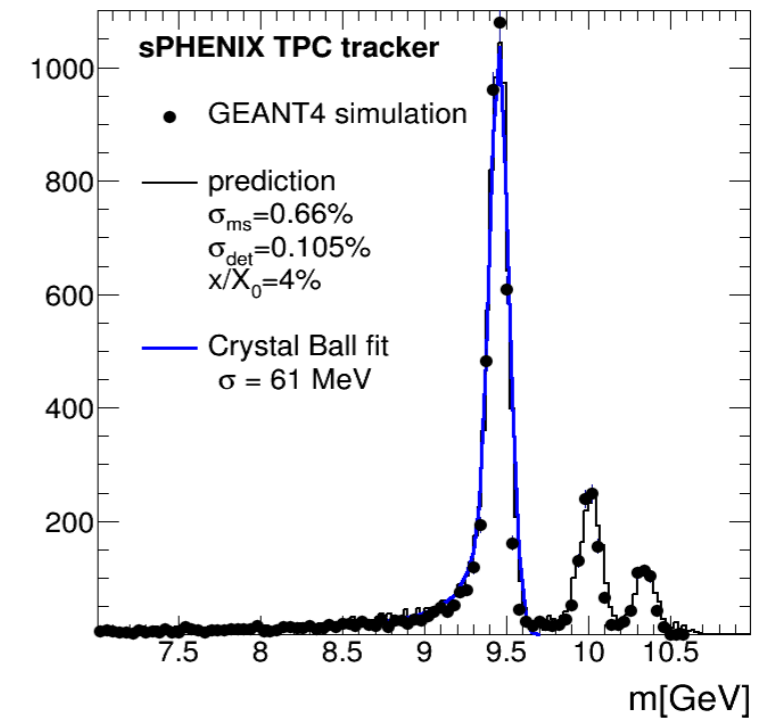
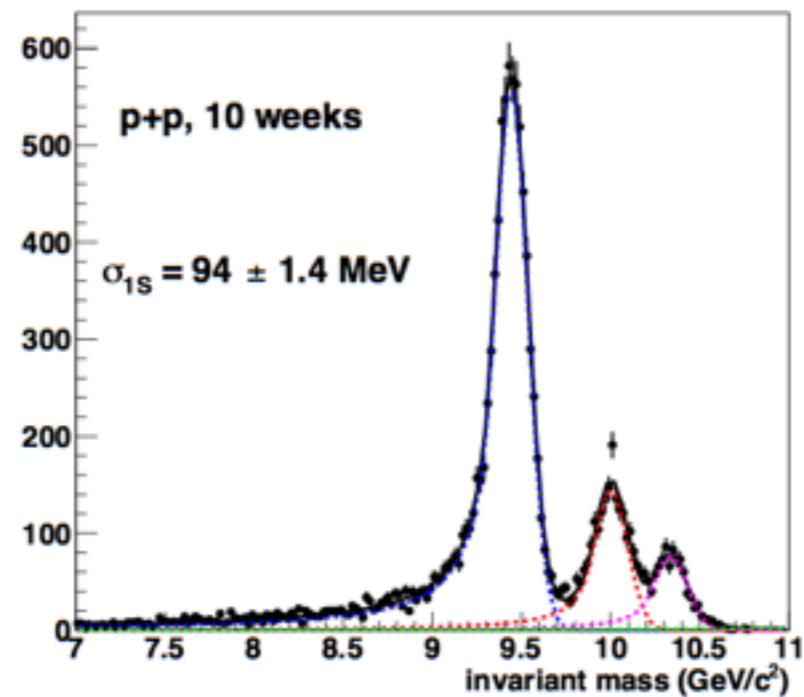
Ron Belmont, Kurt Hill and Jin Huang will collaborate on this

Reminder - what we have shown in public

$Y(1S,2S,3S) \rightarrow e^+e^-$



$Y(1S,2S,3S) \rightarrow e^+e^-$



Silicon strip
+
perfect pixels

no ganged readout

Silicon strip
+
3 layer MAPS pixels

no ganged readout

TPC
+
perfect pixels

no space charge
no event pileup

All need to be taken to a more realistic level

Proposal for sPHENIX tracking scope studies

In all cases add track matching to the calorimeters via fast simulation

1) Start with most attractive option, a full MAPS tracker:

- MAPS inner tracker (3 layers) + ITS like 4 layer MAPS outer tracker in cylinder cell geometry with outer layer at 60 cm
- **Consider de-scoping options from there:**
 - **Reduced outer tracker:**
 - Reduce number of layers
 - Reduce outer radius
 - Evaluate to find minimum configuration that meets each of the major physics goals
 - **Reduced inner tracker**
 - $1/2 \pi$ coverage
 - Two layers
 - Evaluate for each of the major physics goals to see how/if it works

Can be done with existing simulation code

Proposal for sPHENIX tracking scope studies

In all cases add track matching to the calorimeters via fast simulation

2) Substitute Silicon strips for outer MAPS tracker

- MAPS inner tracker (3 layers) + 5 layer silicon strip outer tracker with outer radius 64 cm and ganged strip readout (3 in middle layers, 6 in outer layer)
- **Consider de-scoping options from there:**
 - **Reduced outer tracker**
 - Fewer layers
 - Other?
 - Evaluate to find minimum configuration that meets each of the major physics goals
 - **Reduced inner tracker**
 - $1/2 \pi$ coverage
 - Two layers
 - Evaluate for each of the major physics goals

Can be done with existing simulation code

Proposal for sPHENIX tracking scope studies

In all cases add track matching to the calorimeters via fast simulation

3) Substitute TPC for outer MAPS tracker

- MAPS inner tracker (3 layers) + TPC
- **Consider de-scoping options from there:**
 - **Reduced outer tracker is N/A**
 - (right?, or can the TPC be de-scoped?)
 - **Reduced inner tracker**
 - 1/2 π coverage
 - Two layers

Cannot be done with existing simulations code. We will need to add:

- Momentum smearing code that would simulate effects of space charge
- Pileup of events in the TPC

Charge to the TPC group

These evaluations would be done in the cylinder cell, voxel approach that is currently implemented by Alan for the TPC

Proposal for sPHENIX tracking scope studies

In all cases add track matching to the calorimeters via fast simulation

4) Substitute reused PHENIX pixels for MAPS inner pixels

- Implement ~ 87% live area inherent to the design
- Implement ~ 92.5% working pixels in layer 0
- Implement ~ 72.5% working pixels in layer 1
- Repeat 1, 2 and 3 with this substitution
- Try using an **or** of layers 0 and 1 in tracking

5) For the Upsilon measurement, it may be that **no** inner silicon would be an option. Could try it

Plans and needs

The Upsilon measurement is entirely dependent on tracking

It will be insensitive to the inner tracker **except** that it requires high efficiency

It depends critically on the outer tracker for momentum resolution

We need guidance on the process by which sPHENIX can arrive at detector configurations **that include tracking** that fit within the \$75M budget

We are proposing a systematic study that will show us where to focus for the cheapest tracking options that will let us do the physics

We need improvements to the TPC simulation to allow any realistic evaluation of performance - manpower not clearly identified at present

We need track matching to the EMCal to study its effect on fake tracks - Colorado group is working on this

Backup